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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,203	09/29/2003	Nicholas I. Buchan	HSJ920030156US1	9945

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INTELLECTUAL PROPERTY LAW OFFICE
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EXAMINER

GEORGE, PATRICIA ANN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 03/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/675,203	BUCHAN ET AL.	
	Examiner	Art Unit	
	Patricia A. George	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) _____ is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The applicant's amendment, filed 12/01/2005, overcomes the 112 rejections set forth in the office action of 9/13/2005.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1 and 5-10 are rejected under 35 U.S.C. 103(a) as being obvious over Halahan et al. (USPN 6,897,148) in view of Siniaguine et al. (USPN 6498074).

As for claim 1, Halahan et al. discloses a method for fabricating heads of disk drive assemblies, comprising a Si wafer (FIG. 4, 110) which has been fabricated with a SiO₂ overcoat (120); depositing a layer of DRIE-resistant material (FIG. 15, 1010.1) on said SiO₂ overcoat (120); depositing a patterned layer of RIE-resistant material (1010.3) on said layer of DRIE-resistant material to form a primary mask.

Halahan discloses etching by RIE (fig. 15 and col.8, l.21-24, col.10, l.5-6) through said primary mask (fig. 15, 1010.3) to pattern said SiO.sub.2 (fig. 15, 120) overcoat layer and said layer of DRIE-resistant material (fig. 15, 1010.1).

Halahan discloses removing said primary mask (fig. 15, 1010.3) to expose said layer of DRIE-resistant material (fig. 15, 1010.1) which has now been patterned to form a secondary mask (col.8, l.62-64); etching by DRIE through said secondary mask (fig. 15, 120) to cut said Si wafer (fig. 22 and fig 5, or col.4, l.15-25); and removing said secondary mask (fig. 15, 120).

Halahan discloses the use of DRIE to make a hole in a silicon wafer, but does not disclose cutting the wafer into pieces, as in claim 1.

Siniaguine et al. (USPN 6498074) teaches the wafer is diced only part of the way through, to form grooves which are at least as deep as the final thickness of each chip to be obtained from the wafer. Then the wafer has a backside plasma etch to first expose the cut grooves; remove damage from the chip sidewalls, that is formed in the cutting; and to round the chips' bottom edges and corners (ab.) Siniaguine teaches the method that includes the backside etch of a wafer for the completion of the cut, which smoothes the wafer edges which are damaged by laser or saw cutting, thus prolonging the life of the device (col.1, l.44-46). Siniaguine teaches another benefit with use of plasma etch to cut a wafer is that the grooves' aspect ratio is large enough to reduce the lateral etch rate of the chip sidewalls, allowing more area for on-chip circuitry (ab.).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify the method of Halahan to include a step wherein the wafer is cut into pieces because the reference of Siniaguine illustrates it is beneficial because it frees up real estate that allows more area for on-chip circuitry, and it resolves defects caused by other forms of cutting the wafer, such as chipping and surface damage.

As for claim 5, Halahan discloses the use of the DRIE-resistant material, is the SiO₂ overcoat as the DRIE-resistant material (shown in fig. 16).

As for claim 6, Halahan discloses depositing a patterned layer of RIE-resistant material (fig. 10, 1010.3) on said layer of DRIE-resistant material (fig. 10, 1010.1) to form a primary mask comprises; applying, exposing and developing photo resist (col. 3, l.39-40) to create the pattern (col. 3, l.39 masked is written on pattern); plating the layer of RIE-resistant material into the photo-resist pattern (col. 7, l.42-25 "other process can also be used is written on plating the layer); and stripping the photo-resist (see fig. 16).

As for claim 7, Halahan discloses applying a seed layer (fig.16, 1010.3) of RIE-resistant material before applying said photo resist (fig. 16, 1110).

As for claim 8, Halahan discloses first sputter etching away said seed layer (col. 5, l. 33-35 "any suitable technique" is written on sputter-etching) of RIE-resistant material before RIE.

As for claims 9-10, Halahan discloses removing primary mask by selective wet etching (see col. 8, l. 10-11, in reference to col. 5, l. 34-36).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-4 are rejected under 35 U.S.C. 103(a) as being obvious over Halahan and Siniaguine (see discussion above) in view of Matono (USPN 6,477,019).

As for claims 2, 3, and 4, Halahan discloses RIE-resistant material (fig. 10, 1010.3) is a metal (col.7, l.35-40 - TiW).

Halahan did not choose from the claimed group consisting of Al.sub.2O.sub.3 for the RIE-resistant material.

Matono et al. teaches magnetic head device manufacturing methods (fig. 3), which includes the formation of numerous thin film magnetic head elements, including of a plurality of component layers, on wafers which are cut resulting in multiple individual head blocks pieces (col.2, l. 33-34). Matono teaches use of alumina (col. 6, l.60) for the magnetic gap layers (fig. 4, 8, 11, and 13) (magnetic gap layers are written on the overcoat). Matono teaches the layer of alumina can be selectively patterned vertically, when using reactive plasma methods (col. 2, 22-25).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to combine the method of cutting wafers into individual pieces using DRIE plasma etch, of Halahan and Siniaguine, with the use of alumina as a RIE resistant

material (i.e. hard mask), as taught by Matono, because Matono teaches the layer of alumina can be selectively patterned vertically, when using reactive plasma methods (col. 2, 22-25).

Claim Rejections - 35 USC § 103

Claim 11-13, 15-20 are rejected under 35 U.S.C. 103(a) as being obvious over Halahan and Siniaguine (see discussion above), in view of Matono (see discussion above) and Mandal et al. (USPN 6,171,945).

The combined teachings of Halahan and Siniaguine failed to teach etching by RIE through said RIE mask to pattern the SiO₂ overcoat layer and form a DRIE mask removing RIE mask to expose DRIE mask; from said DRIE-resistant material; etching by DRIE through said DRIE mask; removing DRIE mask.

Mandal et al. teaches etching by RIE (col. 17, l.61-62 "using conventional photolithography and etch processes" is written on RIE and DRIE) through said RIE (518) mask to pattern the SiO₂ overcoat layer (fig. 8F, part. 510) and form a DRIE mask (fig.8F, 514) removing RIE mask (fig.8F, 518, see fig. 8G for post removal) to expose DRIE mask (fig. 8G, 514); from said DRIE-resistant material (fig. 8G, 514); etching by DRIE through said DRIE mask (fig. 8G, 514); removing DRIE mask (col. 18, l.8-10).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify the plasma etch process used for dividing the wafer into a variety of pieces, of Halahan and Siniaguine, to include the well known dual damascene

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methods, of Mandal's invention, because it would reduce the number of steps needed for manufacturing while eliminating limitations of other processing techniques.

As for claims 12 - 13, Halahan discloses RIE-resistant material (fig. 10, 1010.3) is a transitional metal (col.7, l.35-40 - TiW) between group 2 elements and group 13 elements of the periodic table (see <http://www.chemicool.com/> for a periodic table).

As for claim 15, see discussion on claim 5 above.

As for claim 16, see discussion on claim 6 above.

As for claim 17, see discussion on claim 7 above.

As for claim 18, see discussion on claim 8 above.

As for claim 19, see discussion on claim 9 above.

As for claim 20, see discussion on claim 10 above.

Claim Rejections - 35 USC § 103

Claim 14 is rejected under 35 U.S.C. 103(a) as being obvious over Halahan and Siniaguine (see discussion above), in view of Matono (see discussion above), Mandal (see discussion above), and Sheplak et al (USPN 6018861).

Mandal teaches the hard mask is TiW, a transitional metal, but does not specify other materials such as Cu, or NiFe, as listed in claim 14.

Sheplak et al. teaches a method of forming micro-sensor thin-film anemometer, in which copper is used as a hard mask (col.2, l.60-64). Sheplak teaches devices formed according to this method show a significant improvement.

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify the plasma etch process used for dividing the wafer into a variety of pieces, of Halahan and Siniaguine, to include use of a copper hard mask, of Sheplak, because Sheplak teaches a significant improvement to the device.

Response to Response to Arguments

Applicant's arguments filed 12/01/05 have been fully considered but they are not persuasive.

As to applicant's argument on "mask selectivity" (p. 6), it is noted that "mask selectivity" is not recited in the rejected claim(s), therefore this argument is not commensurate with the scope of the claims.

Throughout the remarks, filed on 12/01/05, applicants repeatedly argue that secondary references do not reference the term DRIE, (as in page 7, 8, and 9) when the primary reference (Halahan et al of USPN 6,897,148) clearly states "the opening may be formed by a masked etch, a laser, or in any other way known or to be invented, in one embodiment, a deep reactive ion etch (DRIE) is use...". In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. (See MPEP 7.37.13.) Applicants argue, on page 10 that "...those skilled in

the art would not understand TiW to be useful as a DRIE-resistant masking material."

Examiner maintains that Halahan et al. of USPN 6,897,148 clearly shows TiW is used as a DRIE-resistant masking material. Although the reference may never explicitly uses the term "mask", the reference illustrates that the TiW layer functions as a mask to pattern/protect the layer under it by simple concealment. Applicants argue, on page 10, that silicon carbide is not known as a DRIE-resistant material. Examiner disagrees for the same reasons stated above and maintains any material used as a stop must be resistant to the etch, therefore a DRIE resistant material. The examiner interprets the meaning of the term mask to be: something that serves to conceal or disguise (see Merriam-Webster Online Dictionary; mask; definition 2 a; <http://www.m-w.com/cgi-bin/dictionary>). Since the layer beneath the TiW and silicon carbide layers are not etched during DRIE, these layers are considered to have the property of being DRIE resistant mask materials.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure is as follows: **A five-layer film MCM-Si design oxynitride dielectrics** by Jo Lernout, Alcatel Telecom, Antwerp, Belgium, 1998, page 5; **Producing Integrated Circuits With X-ray Lithography** by Ben Braun in 1998, page 1.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia (Patty) George whose telephone number is (571) 272-5955. The examiner can normally be reached on weekdays between 7:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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MADINE G. NORTON
SUPERVISORY PATENT EXAMINER

